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Effect of Insect growth regulators on weight loss of the Lepidopterous pests

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ABSTRACT: Insect growth regulators activity against the Lepidoterous pest *Euproctis* icilia and *Euproctis fraterna* was observed. The effect of Penfluron and Diamino-furyl-s-triazine. Two type of treatment given larval feeding treatment. A activity on weight loss of the both experimental insects larvae included third instar as well as fifth instar. The administration of penfluron and diamino-furyl-s-triazine was done by feeding technique to *Euproctis icilia* and Euproctis *fraterna* larvae, to see its interaction on the experimental insect. The effect of the chemical at lethal and sublethal levels was recorded. The parameter of study was growth and weight loss during exposure period.

Keywords: Euproctis icilia, Euproctis fraternal, penfluron & diamino-furyl-s-triazine.

INTRODUCTION

Despite a host of new weapons and vast annual expenditure, little progress was made in the age-old battle against the insect. Fecundity of these creatures is frightening. Some pass through their entire life cycle, from egg to adult in a matter of days or week, producing dozen of generations a season, thus giving them enormous evolutionary advantages with the discovery of synthesis insecticides in 1940, which was refered as first generation pesticide, it was believed that the pest population will easily be eliminated but the control of some of the pests even below economic injury level, could not be achieves. Besides, they also created many side problems such as developments of resistance, secondary pest outbreak, resurgence and pollution to ecosystem. The fecundity of the surviving adults avoiding sublethal dosage is also increased. (Knustson, 1951 and Afifi and Knutson, 1965). Such problems forced the economic entomologists to proceed further in search of safer methods of pest management and second and third generation of pesticides came into existence by using the chemosterilant, pheromones and juvenile hormones, etc., but the desired success could not be achieved by any of them.The insect growth regulator, a fourth generation pesticide, accidently came into existence in the Laboratory of Philips Duphar, of Netherlands, while preparing the herbicides.

First insect growth regulator synthesized, was diflubenzuron, which was from Benzoyal phenyl urea group. Later, different groups of insect growth regulators, having chitin biosynthesis inhibiting property, were identified. They exhibit lethal action in juvenile stages and sterility in sexually mature adults, thus the pest population declines very rapidly. Besides, they also inhibit the food consumption and growth of individuals, which survive sublethsal treatments. (Flint et al., 1978; Zepp et al., 1979; Hopkins et al., 1982; Velcheva 1083; Lecheva 1985; etc.), (Srivastava and Srivastava, 1990, Chattoraj and Singh, 1972; Singh, 1974; Singh, 1976;) they have also reported greater amount of weight loss in earlier stage.

The bioefficacy of insect growth regulators is generally noticed during ecdysis, as it disturbs the process of chitin deposition due to which the insect dies. It also results in failure to feed, due to displacement of mandibles and labrum or blockage of the gut. These substance also produce delayed symptoms, in which the adults fail to escape from pupal skin and therefore cannot fly, feed and mate.The chemicals used in

the presents study belong to Benzoyl phenyl urea and triazine group. They are penfluron, (2, 6-difluro-N-[[[4-(triflurомethyl) phenyl] amino] benzamide and diamino-furyl-s-triazine, (2,6 – diamino-6-(2-furyl)-s-triazine) respectively. Triazine was previously used as chemosterilant in 1960, with larvicidal action, but lateron came to be known as an insect growth regulatore with chitin biosynthesis inhibing property.The insect selected for the investigations belongs to be the order lepidotera. The idea to select the lepidoterous pests is due to the fact that it damages large number of important crop plants and economically are of great importance. The pests taken for bioassay assessment were *Euproctis icilia* Stoll. and *Euproctis fraternal* Mo. of the family Lymantriidae. They are commonly known as hairy caterpillars and feed on castor (*Ricinus communis* L.) an important oil seed crop. They are found almost everywhere in India. The larvae occure in abundance and feed voraciously so much so, that they defoliate trees completely, leaving only stems and branches.The selected lepidoterous pests were administered the insect growth regulators, by feeding and residual technique. The objective behind the present work was to establish the interaction of the chemicals against experimental insect pests at lethal as well as sublethal levels. The parameter of study included growth and loss of weight during exposure period, at sublethal level of treatments.

MATERIAL AND METHODS

The materials that were used and the methods adopted for the proposed investigation of insect growth regulators with lepidoterous pests. The insects that were exposed to chemical for observation were the hairy caterpillars. The pests used *Euproctis icilia* Stoll. and *Euproctis fraterna* Mo., the chemicals taken Benzoyl phenyl urea (Penfluron) and Triazine (Diamino-furyl-s-triazine). The eggs and the larvae of the lepidoterous pests were collected froim the farms and cultured in the laboratory on their natural died. Room these test insects of known age and stage were taken for different experimental work. The eggs that were collected were kept in between the leaves which served as food for the newly hatched larvae. The final moult of these larvae led to sexually dimorphic adults. The rearing of different lepidoterous pests taken for the proposed work was done. *Euproctis icilia* and Euproctis fraterna both insect pests we found on the same host plant, rearing was done in similar manner. The eggs and the larvae were collected from the castor plants (*Ricinus communis* L.) found on the farm of Kulbhaskar Ashram College and Agriculture Institute, Allahabad. The rearing was done in wooden insect cages with iron mesh on its sides. The cages were of 60 x 60 x 45 cm size. These were kept on elevated platform and the four stands were put on earthen pots filled with water, to prevent the ants and other insects from entering it and damaging and killing the insects.

Every morning and evening the larvae were supplied with their natural diet (castor leaves) until population. The cages had to be cleaned everyday and their faecal matter thrown, in order that the insects could survive. The adults which emerged were provided with 10% honey mixed sugar solution soaked in cotton which was kept in small petridish. Fresh castor leaves were put in the wooden cages for the adult females to lay eggs on them, after pairing had taken place. Later, the eggs were collected and placed in between the green and succulent castor leaves which served as food for the newly hatched larvae. The laboratory temperature during rearing and experimental was 29 ± 2°C.

RESULTS AND DISCUSSION

The administration of penfluron and diamino-furyl-s-triazine was done by feeding technique to *Euproctis icilia* and *Euproctis fraterna* larvae, to see its interaction on the experimental insect. The effect of the chemical at lethal and sublethal levels was recorded. The parameter of study was growth and weight loss during exposure period.

Analysis Tables (Larval feeding treatment):

Table 1: Effect of Penfluron on weight gain/loss during exposure period in third instar larval feeding treatment of *Euproctis icilia*

Concentration	Avg. no. of larbae treated	Average weight per larva		Variation in larval weight after treatment	
		Before Treatment	After Treatment		
(ppm)	(no.)	(g)	(g)	(g)	(%)
Control	15	0.028	0.037	+ 0.009	+ 32.14
0.001	15	0.028	0.033	+ 0.005	+ 17.85
0.01	15	0.027	0.024	- 0.003	- 11.11
0.1	15	0.027	0.023	- 0.004	- 14.28
1.0	15	0.027	0.023	- 0.004	-14.28
50.0	15	0.027	0.019	- 0.008	- 29.62

+ = weight gain, - = weight loss

Table 2: Effect of Penfluron on weight gain/loss during exposure period in fifth instar larval feeding treatment of *Euproctis icilia*

Concentration	Avg. no. of larbae treated	Average weight per larva		Variation in larval weight after treatment	
		Before Treatment	After Treatment		
(ppm)	(no.)	(g)	(g)	(g)	(%)
Control	15	0.337	0.447	+ 0.110	+ 32.64
0.001	15	0.336	0.400	+ 0.064	+ 19.04
0.01	15	0.337	0.348	- 0.011	+ 3.26
0.1	15	0.337	0.330	- 0.007	- 2.07
1.0	15	0.337	0.320	- 0.017	- 5.04
50.0	15	0.337	0.300	- 0.037	- 10.97

+ = weight gain, - = weight loss

Table 3: Effect of Diamino-furyl-s-triazine on weight gain/loss during exposure period in third instar larval feeding treatment of *Euproctis icilia*

Concentration	Avg. no. of larbae treated	Average weight per larva		Variation in larval weight after treatment	
		Before Treatment	After Treatment		
(ppm)	(no.)	(g)	(g)	(g)	(%)
Control	20	0.027	0.050	+ 0.023	+ 85.18
0.001	20	0.027	0.035	+ 0.008	+ 29.62
0.01	20	0.027	0.034	+ 0.007	+ 25.92
0.1	20	0.027	0.025	- 0.002	- 7.40
1.0	20	0.027	0.023	- 0.004	- 14.81
50.0	20	0.027	0.020	- 0.007	- 25.92

+ = weight gain, - = weight loss

Table 4: Effect of Diamino-furyl-s-triazine on weight gain/loss during exposure period in fifth instar larval feeding treatment of *Euproctis icilia*

Concentration	Avg. no. of larbae treated	Average weight per larva		Variation in larval weight after treatment	
		Before Treatment	After Treatment		
(ppm)	(no.)	(g)	(g)	(g)	(%)
Control	10	0.179	0.280	+ 0.101	+ 56.42
0.001	10	0.179	0.190	+ 0.011	+ 6.14
0.01	10	0.177	0.185	- 0.008	+ 4.51
0.1	10	0.176	0.180	- 0.004	+ 2.27
1.0	10	0.176	0.174	- 0.002	- 1.13
50.0	10	0.176	0.170	- 0.006	- 3.40

+ = weight gain, - = weight loss

Table 5: Effect of Penfluron on weight gain/loss during exposure period in third instar larval feeding treatment of *Euproctis fraterna*

Concentration	Avg. no. of larbae treated	Average weight per larva		Variation in larval weight after treatment	
		Before Treatment	After Treatment		
(ppm)	(no.)	(g)	(g)	(g)	(%)
Control	30	0.023	0.037	+ 0.014	+ 60.86
0.001	30	0.022	0.027	+ 0.005	+ 22.72
0.01	30	0.022	0.021	- 0.001	- 4.54
0.1	30	0.023	0.020	- 0.003	- 13.04
1.0	30	0.023	0.018	- 0.005	- 21.04
50.0	30	0.022	0.017	- 0.006	- 27.27

+ = weight gain, - = weight loss

Table 6: Effect of Penfluron on weight gain/loss during exposure period in fifth instar larval feeding treatment of *Euproctis fraterna*

Concentration	Avg. no. of larbae treated	Average weight per larva		Variation in larval weight after treatment	
		Before Treatment	After Treatment		
(ppm)	(no.)	(g)	(g)	(g)	(%)
Control	20	0.023	0.032	+ 0.009	+ 39.13
0.001	20	0.023	0.028	+ 0.005	+ 21.73
0.01	20	0.026	0.027	- 0.001	- 3.84
0.1	20	0.026	0.025	- 0.001	- 3.84
1.0	20	0.024	0.022	- 0.002	- 8.33
50.0	20	0.023	0.018	- 0.005	- 21.73

+ = weight gain, - = weight loss

Table 7: Relative larval growth effect of insect growth regulators against different lepidopterous pests, when the larvae were exposed to different treatments

Name of the chemical/insect	Treatment	Heterogeneity*	Regression equation	E.C. 50	Relative toxicity	Order of efficacy
THIRD INSTAR						
PENFLURON						
Euproctis icilia	Larval feeding	X^2 =2.785* (3)	Y=0.09318x + 4.93734	4.703	1.00	1
Euproctis fraterna	Larval feeding	X^2 =6.362* (3)	Y=0.14552x + 4.93788	2.672	1.76	2
DIAMINO-FURYL-S-TRIAZINE						
Euproctis icilia	Larval feeding	X^2 =20.202 (4)	Y=0.16550x +4.53776	620.700	1.00	1
Euproctis fraterna	Larval feeding	X^2 =28.246 (4)	Y=0.18522x + 4.75088	22.13	28.04	2
THIRD INSTAR						
PENFLURON						
Euproctis icilia	Larval feeding	X^2 =32.995 (4)	Y=0.24775x + 4.38789	295.50	35.49	2
DIAMINO-FURYL-S-TRIAZINE						
Euproctis icilia	Larval feeding	X^2 =34.076 (4)	Y=0.29492x +3.81417	10490.00	1.00	1

***Heterogeneity**= The data was not found to be heterogeneous at P = 0.05; Y= Probit reduction in larval growth;X=Log concentration; E.C. 50= Effective concentration calculated to give 50% reduction in larval growth. + = weight gain, - = weight loss*

CONCLUSION

Loss of weight in the experimental larvae in comparison to its initial weight during exposure period was observed. Weight loss might be due to the irritation in the body by the action of the chemical, which poisons it. In order to remove the poisoning effect, secretion, excretion and regulation takes place due to which great amount of water is lost, thus reducing the body weight. Apparent symptoms of poisoning such as shrinkage in the body, discharge of fluid from mouth and anus, increased activity, regulation, body convulsion were observed in each experiment. In the previous years, except Srivastava and Srivastava, 1990, no other worker has regulators. However, literatues are available on weight loss with insecticides. Like insecticides, insect growth regulators cuses poisoning symptoms and so may be compared with them. The table-1 represented the chemical exhibiting weight loss during exposure period specially at higher concentrations. As the concentration was increased, weight loss increased with it and was maximum by 29.62% at 50 ppm, where as lower concentration showed less reduction in weght loss i. e., by 11.11 % at 0.01 ppm level. The loss of weight might be due to irritation, produced by the chemical or the insect did not find the treated food palatable. The secretion, excessive excretion and regurgitation amounts to great water loss from the body thus reducing the body weight. The table-2 represented Data reveals weight loss during exposure period at lower as well as higher concentration levels. Minimum andight loss was recorded 2.07 and 10.97% at 0.1 and 50 ppm levels in test. Weight loss might be due to secretion, excretion and regurgitation, due to which large amount of water is lost from the body. The table-3 represented larval feeding treatment weight loss during exposure period was recorded in the treated larvae only at higher concentration in comparison to the initial weight. Maximum loss was recorded at 50 ppm level of feeding treatment and was 25.92%. At 0.1 ppm, minimum loss of 7.40 % was

recorded. The loss may be due to the irritating action caused by the chemical. Secretion, excretion further adds to oss of weight. The table-4 represented data reveals that weight loss was exhibited at higher treatment levels during exposure period in comparison to initial weight. The tested concentration showed marked increase in loss of weight. Reduction in weight was recorded at 1.0 and 50 ppm by 1.13 and 3.40% respectively. Weight loss may be due to excessive amount of water loss through secretion, excretion and regurgitation in treated larvae. The table-5 represented effect of penfluron on weight loss was recorded at different tested levels, in comparison to the initial weight. Dta shows that there is marked increase in loss of weight at various concentration levels in test, particularly at lower concentrations. Minimum and maximum weight loss recorded was 4.54 and 27.27% at 0.01 and 50 ppm, respectively. The chemical poisoned the food due to which shrinkage in the body, discharge of fluid from the mouth and anus and regurgitation was observed in the treated larvae. These intoxication symptoms might be the causes for loss weight in the larvae. The table-6 represented data reveals that when the chemical was administered in the food and was given to the larvae, weight loss was observed at almost all the tested concentrations. There was an increase in reduction in larval weight in comparison to the initial weight, with increase in concentration levels. Maximum reduction in weight during exposure period was recorded 21.73% at 50 ppm level. Minimum reduction by 3.84% was recorded at 0.1 ppm level in test. The loss of weight in comparison to its initial weight might be due to irritating action of the chemical. Also great amount of water loss takes place due to secretion, excretion and regurgitation in experimental larvae resulting in further loss in body weight. In present investigation, weight loss during exposure period was observed. Results shows that weight loss was found to be more in third instar than fifth instar larvae of experimental insects. The present research work is in corroboration with the findings of earlier workers (Srivastava and Srivastava, 1990, Chattoraj and Singh, 1972; Singh, 1974; Singh, 1976;) as they have also reported greater amount of weight loss in earlier stage.

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REFERENCES

1. Abbot W. S. (1925) A method of computing the effectiveness of an insecticide, J. Econ.,; 18: 265-267.
2. Abdel Monem A. H. and R. O. Mumma (1981) Comparative toxicity of some molt-inhibiting insecticides to the gypsy moth, *J. Eco. Ent.*, 74 (2), 176-179.
3. Bijloo J. D. (1975) An original insecticide diflubenzuron. Physico- chemical characteristics, biological properties mode of action, *Phytiatric Phytopharmacie*, 24 (3), 147-148.
4. Chattoraj A. N. and D. R. Singh (1972) Studies on weight and water loss in the larvae of P. ricini with certain insecticides, *Proz. Natl. Acad. Sci India 42 (B) Para II,* 169-172.
5. Chattoraj A. N. and S. Dwivedi, (1980) Effect of Penfluron on the Sterility and mortality of Spodoptera litura (Boisd.), *Comp. Phys. Ecol.*, 5 (4), 310-313.
6. Chattoraj A. N. and V. P. Sharma (1964) Weight and water loss in the P. Americana with application of certain insecticides, *Beitr. Ent.*, 14, 525-532.
7. Finney D. J. (1952) Probit Analysis Cambridge University Press, 318.
8. Flint H. M. and R. L. Smith (1977) Laboratory evaluation of TH 60-40 against pink bollworm, *J. Econ. Ent.,*70 (1), 51.
9. Grosscurt A. C. Diflubenzuron (1978) Some aspects of its ovicidal and larvicidal mode of action and an evaluation of its practical possibilities, *Pestic. Sci.*; 9, 373-386.

10. Khan M. M. and B. B. L. Srivastava (1989) Biological effect of insect growth inhibitor, diamino-furyl-s-triazine (AI3-22641) on development and reproductive potential of *Euproctis icilia* Stoll. Annals Agric. Sci. Fac. Agric. Ain Shams Univ. *Cairo Egypt*, 34 (2), 1215-1226.

11. Sanjay Cyril Masih and Jeetendra Kumar Vaishya (2013) effect of insect growth regulators on weight loss of the lepidopterous pests by larval residual treatment, *Life Science Bulletin*, 10(1), 5-9.

12. Singh, D. R. (1976) Influence of insecticides on the loss of water in the larvae of Philosamia ricini Hutt Ind., *J. Sericulture*, 15 (1).

13. Singh D. R. (1974) Loss of water in the larvae of Achoea janata (L.) treated with insecticides Zeitsch. Angew Ent., 75, 284-290.

14. Singh G. and D. Singh (1988) Potential experiment with 2 J. H. analogues, *J. Insect Sci.*, 1(2), 189-190.

15. Srivastava, B. B. L. and M. M. Khan (1988) Contact toxicity of penfluron on Pericallia ricini larvae, *Ind. J. Agric. Sci*,. 58 (3), 240-241.

16. Srivastava, N. C. and B. B. L. Srivastava (1990) Influence of chitin biosynthesis inhibitor, diamino-furyl-s-triazine on larval food consumption and growth of Pericallia ricini F., *J. Appl. Ent.*, 109, 410-413.

17. Wellinga K.., Mulder R. and J. J. Van Daalen (1973) Synthesis and laboratory evaluation of 1-(2,6-disubstituted benzoyl)-3-phenyl ureas-a new class of insecticides II influence of the acyl moiety on insecticidal activity., *J. Agric. Food. Chem.*, 21, 993-998.